REMARKS

A new set of claims, numbered 79-111, has been submitted. These new claims have been written to overcome the objections raised in the PCT Search Report, and are believed to clearly define the present invention.

Over the years, a variety of processes and procedures have been developed for fabricating optical waveguides such as optical fibers, and for fabricating lenses for use with such fibers. However, there has not been an accurate procedure for monitoring the progress of the fiber or lens manufacturing process, so the resulting fibers and lenses have not always exhibited the desired light-emitting characteristics.

The present invention improves the speed and accuracy of known waveguide fabrication procedures by first providing a theoretical simulation of the desired waveguide and lens characteristics. This may be a mathematical simulation of the geometric shape of the lens and waveguide structures, and of their optical characteristics or parameters, for example. The structure being fabricated is then monitored during the fabrication process to obtain the current geometric and optical characteristics of the structure, and these measured characteristics are compared with the simulation and the fabrication process adjusted as needed.

A key to the present invention is that the characteristics of the structure are monitored by near-field optics in addition to far-field measuring techniques and topographic imaging of the surface of the structure. The near-field optics measure such characteristics as the intensity, polarization, phase properties, spot size, mode field diameter, waist diameter, and the like for the emitted light. Such measurements are integrated with those obtained by far-field and topographic measurements for iterative comparison with the simulation to provide accurate control of structure fabrication. Such measurements can also be used to characterize a lens after the manufacturing process has been completed.

In one aspect of the invention, atomic force microscopy is used to measure topographic features such as the radius of curvature of a lens, its cone angle, the taper of a fiber, and the like, while near-field optics are used to measure the light distribution in the lens; i.e., the direction from which the rays of light reading a lens at the end of an optical waveguide are coming, and the phase characteristics of that light. These measurements are combined with far-field measurements, as by a microscope, and the resultant measurements are compared with the simulation. These combined measurements provide the information needed to accurately characterize the lens and provide data for correcting any detected deviations.

The claims now presented are believed to be clear and definite, and favorable consideration is requested.

Respectfully submitted,
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